

Secondarily, such use could disrupt existing ant interaction should workers preferentially tend the larger *S. martialis* larvae over *C. thomasi bethunebakeri* owing to the possibility of a more significant food reward.

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NEW LARVAL HOST PLANT FOR *LYCAEIDES MELISSA MELISSA* IN WISCONSIN AND MINNESOTA AND POTENTIAL THREAT TO *LYCAEIDES MELISSA SAMUELIS* (LYCAENIDAE)

Additional key words: Fabaceae, *Coronilla varia*, exotic species

The melissa blue, *Lycaeides melissa* (W. H. Edwards), utilizes a number of plants in the family Fabaceae as larval foodplants, with members of the genera *Astragalus* L. and *Lupinus* L. prominently represented (Scott 1986). The nominate subspecies of this butterfly occurs throughout western Minnesota, most commonly in remnants of the prairie that originally covered that part of the state, where native species of *Astragalus* appear to be the principal hosts. We have records from *A. crassicaarpus* Nutt., *A. adsurgens* Pallas, *A. missouriensis* Nutt., *A. flexuosus* Douglas, and *A. lotiflorus* Hook., as well as from a loco-weed, *Oxytropis lambertii* Pursh., a member of the same tribe in the Fabaceae as *Astragalus* (Gleason & Cronquist 1991). The butterfly is also sometimes found in the same part of the state in association with alfalfa, *Medicago sativa* L., in non-native habitat, e.g., along roadsides, in hayfields, or in pastures, where few prairie species are present (RPD, personal observation). Alfalfa is the principal larval host for some populations of *L. melissa* in western North America (Nice & Shapiro 1999). We report here the discovery of colonies of *L. m. melissa* in western Wisconsin and eastern Minnesota that are using another introduced legume as larval host, crown-vetch, *Coronilla varia* L. The use of this plant does not appear to have been previously reported. This is also the first reported occurrence of the nominate subspecies of *L. melissa* in Wisconsin.

In late July and early August 1994, CL encountered second-brood adults along a short stretch of high-voltage transmission line right of way in St. Croix County, Wisconsin, just northeast of the town of Hudson. Females were observed ovipositing on crown-vetch and on sweet clovers, *Melilotus alba* Medikus and *M. officinalis* (L.) Pallas. Several adults of both sexes

were collected in 1994 and on a subsequent visit on 25 July 2002. Females are typical *L. m. melissa*, with a fully-developed, continuous submarginal orange band on the dorsal forewing as well as the hindwing. Voucher specimens are deposited in the University of Minnesota Insect Collection, University of Minnesota, St. Paul.

RPD revisited the site 6 July and 12 July 2003 and found several second-brood larvae feeding on crown-vetch. All were feeding on leaves except for a probable second instar that was feeding on a very immature developing inflorescence. Early instars feeding on foliage mined out the mesophyll layer, leaving whitened "windowpanes" of epidermal tissue in the leaflets of the pinnately compound leaves. Late instars consumed epidermis as well, stripping most or all the leaflets from a leaf and leaving the rachis studded with the minute leaflet pedicels. These tell-tale signs of larval feeding were more readily found than the larvae themselves. Sweet clover plants were uncommon, and no interactions of females with these were observed. The only other legume noted at this site was round-headed bush-clover, *Lespedeza capitata* Michx., and there was no evidence of use of this plant. Adult activity, except for nectaring, was closely associated with crown-vetch patches. Three larvae were collected from the site on the 12 July visit and reared on potted crown-vetch plants. All developed into adults; two males and a female.

The power line right of way is a former railroad bed that is cut down a few feet below grade in the stretch occupied by the butterfly colony. The soil is a loamy coarse gravelly sand. At the time of the discovery, agricultural fields bordered the site on the north and a windbreak of elm and green ash trees bordered it on the south. The fields have subsequently been converted to

large-lot housing. The corridor itself is dominated by crown-vetch; leafy spurge, *Euphorbia esula* L.; spotted knapweed, *Centaurea maculosa* Lam.; and Canada bluegrass, *Poa compressa* L. Some prairie species such as stiff tickseed, *Coreopsis palmata* Nutt.; rough blazing star, *Liatris aspera* Michx.; Indian grass, *Sorghastrum nutans* (L.) Nash; porcupine grass, *Stipa spartea* Trin.; and little bluestem, *Schizachyrium scoparium* (Michx.) Nash, are present but not common. The crown-vetch-infested stretch of the right of way extends only about 200 meters. CL surveyed about 5 km of the right of way continuing northeast of the colony location in 1994 but encountered no additional occurrences of the butterfly. A search by RPD of about 2 km of this same stretch on 30 July 2002 was similarly unsuccessful. However, on a brief visit on 14 July 2004 RPD found butterflies around the large transformer substation 100 m west of the original location, on the north side of the old railroad. Freshly-emerged second-brood adults were flying about in thin vegetation on the dry, gravelly apron that surrounds the fenced substation. Depauperate crown-vetch plants are common here.

In August 1996 DH discovered another colony of *L. m. melissa* that is using crown-vetch as a larval host, although in this case it is also using ground-plum, *Astragalus crassicaarpus* Nutt. This colony is in eastern Minnesota, ca. 4.5 km east of Dennison in Goodhue County. During this and several subsequent visits we have observed butterflies to be common along a ca. 0.7 km stretch of west-facing highway cutbank in weathered limestone and shale where crown-vetch is the major plant cover and in a small remnant of degraded prairie thoroughly invaded by crown-vetch on gentler slopes above part of the cutbank. A few small aggregations of ground-plum plants occur in the prairie remnant. Cultivated fields border the cutbank and prairie remnant on the east. Woods and cultivated fields occupy the small valley on the west side of the road.

On 13 June 2004 RPD observed a female oviposit on the stem of crown-vetch plant at this site, and another oviposit on a grass blade while crawling down a crown-vetch stem. During visits on 26 June and 4 July 2004 RPD found a total of 12 larvae feeding on crown-vetch, most commonly on foliage, but occasionally on flowers. Larvae were discovered by searching for the distinctive behavior of attending ants, a large, dark species of *Formica* L. whose mounds were common. (Attending ants at the Hudson site were small, probably belonging to at least two species). Two of these larvae were collected and reared to pupation on crown-vetch. A braconid wasp emerged from one pupa, a male butterfly from the other.

On the 13 June visit a number of ova and two first-

instar larvae were observed on ground-plum plants, and on the two subsequent visits 12 larvae were observed feeding on ground-plum. Approximately one-third of the ground-plum plants examined had ova, larvae, or "windowpaning" evidence of larval feeding. Count was not kept of the number of searches of crown-vetch plants, but the success rate was probably no greater than one in 20. The compact habit of ground-plum makes finding ova, larvae, and feeding damage on it easier than on the more diffuse crown-vetch plants, but the difference does not seem enough to account for the different success rates; rather, a preference for ground-plum by ovipositing females seems to be indicated. However, the number of ground-plum plants present in this site is too small to have produced the number of *L. m. melissa* adults observed. Crown-vetch thus appears to be the major host plant of this colony.

The adaptation to crown-vetch by *L. m. melissa* is of more than ordinary interest because the widespread establishment of this plant along roadsides in the northeastern U.S. provides ready corridors for this taxon to invade the range of the federally endangered Karner blue, *Lycaeides melissa samuelis* Nabokov. Recent allopatry of these two taxa appears to be based on their traditional host-plant dependencies. Wild blue lupine, *Lupinus perennis* L., the only reported larval host for *L. m. samuelis* (Lane & Weller 1994), grows naturally only in sands and does not occur in the prairie habitat of *L. m. melissa* (Ownbey & Morley 1991). Conversely, none of the *Astragalus* or *Oxytropis* species commonly used by the latter occur in the sand barrens habitat of *Lupinus perennis* (Cochrane & Iltis 2000). Crown-vetch planted along roadsides breaks down this separation. The Goodhue County, MN, colony of *L. m. melissa* is at the edge of the range of *L. m. samuelis*, 85 km north-northwest of a colony of the latter in Winona County, MN. The Hudson, WI, colony of *L. m. melissa* is within the historic range of *L. m. samuelis*, 60 km southeast of the former station of the latter in Anoka County, MN (now extirpated) and 65 km south of the large population in northwest WI. It is also only 65 km west of colonies in Dunn County, WI, that are part of the large central Wisconsin population. This colony represents a clear case of range extension based on adaptation to crown-vetch.

Opportunities for interbreeding that this novel physical proximity would produce could pose a threat to *L. m. samuelis* as a distinct taxon. Because genetic similarity between these taxa is within the range observed between subspecies (Packer et al. 1998; Nice & Shapiro 1999), it is possible that matings between them will produce fully viable offspring. This hybridization could threaten the continued identity of

L. m. samuelis. Such a scenario represents a possibly unrecognized way in which exotic species introductions may affect biodiversity.

The use of alfalfa as a host plant by *L. m. melissa* in western Minnesota has not resulted in an eastward expansion of its range, despite the common occurrence of alfalfa hayfields in the region. The only known occurrence of this taxon associated with alfalfa east of its prairie range in Minnesota is a 1977 record from Morrison County, within the forested region of the state, where RPD encountered a few adults, including both sexes, in an alfalfa hay field (specimens in the University of Minnesota Insect Collection). The present status of the butterfly at this location is not known. It may be that the regular haying of these fields prevents establishment of persistent colonies. Crown-vetch may provide a more suitable basis for range expansion, as most roadside plantings are infrequently mowed. It has supported expansion of another specialized legume-feeder that has adapted to its use, the wild-indigo dusky wing, *Erynnis baptisiae* (Forbes) (Shapiro 1979; Opler 1992). The two locations where we have documented the use of crown-vetch by *L. m. melissa* are droughty habitats where the plants are somewhat stunted and do not form lush, dense mats typical of mesic, fertile sites. If these conditions are important for the successful establishment of this butterfly on crown-vetch, its range expansion may be impeded as such habitats are more discontinuous than the occurrence of crown-vetch itself. However, workers should be on the watch for this butterfly in eastern Minnesota and western Wisconsin.

An effort to determine whether the two taxa will naturally mate, and whether hybrid offspring show any evidence of inviability should be undertaken. If, as we expect will be the case, the two will mate in nature and produce fully viable offspring, eradication of crown-vetch-feeding colonies of *L. m. melissa* may be advisable to protect *L. m. samuelis*. Total eradication of crown-vetch is probably not possible, but reducing it in the vicinity of Karner blue populations would be feasible. The state transportation departments in both Minnesota and Wisconsin have removed crown-vetch from their seed mixes, but many counties and townships in these states continue to plant it (Gary Birch, WI DOT, and Larry Puchalski, MN DOT, personal communication). These entities should be encouraged to discontinue planting crown-vetch in the vicinity of Karner blue populations.

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